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Economic implications of Annex I commitments for developing countries

teri

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Preface

An important issue raised in several forums in relation to any proposed limitation on emissions of greenhouse gases in the Annex I countries covers the issue of inter-country impacts that arise therefrom. Several developed country policy-makers and analysts point to the danger to developing countries from limitations imposed on the use of fossil fuels in the developed countries. Undoubtedly, this is a question which can be answered by carrying out analysis specific to sets of countries in the developed as well as the developing world. However, some generalizations are possible based on such country-specific analysis. In this document the generic question of economic implications of Annex I commitments for developing countries has been assessed by looking at case studies of three specific developing countries and their international trade linkages with the developed world.

The countries chosen for this analysis are India, Indonesia, and Bangladesh. While India has a fairly large industrial base and rising component of manufactured goods in its basket of exports. Indonesia is essentially an oil exporting country, which nevertheless faces the prospect of becoming a net oil importer in a fairly short period of time. In the case of Bangladesh, exports are still essentially based on raw materials and agricultural products, whereas imports consist largely of manufactured goods. As would be expected, the analysis in this paper reveals a variety of impacts of Annex I commitments on the three countries chosen, but it is obvious that the impacts would not have major consequences even if the taxes imposed on carbon in the developed countries are substantial. Of course, these countries would require to adjust to a new regime of carbon taxes in the developed countries, and this needs careful preplanning in the event of any protocol being accepted and signed for limitation of GHG emissions in the Annex I countries.

An important issue that arises out of this concern relating to adjustment of export baskets in the developing countries is the need for diversification of exports in anticipation. This would obviously require investments in specific sectors of the economic systems in these countries. If there is a protocol for binding commitments on the part of the Annex I countries, it would be useful for multilateral and bilateral aid organizations to focus on investments and building up capacity to reflect the new realities and for adjustments in the exports mix in consonance with the new GHGs limitation scenario ahead. Of course, national governments would also have to take proactive decisions to meet the challenge.

This paper does not attempt to provide any definite answers to the complex set of issues that lie within the problem being analysed, but merely act as a basis for debate, that hopefully would lead to future action. Nevertheless, the results of this basic analysis do indicate the fact that there is no need for fear disastrous impacts on the developing countries resulting from binding Annex I country for commitments.

R K Pachauri
Director, TERI

Economic implications of Annex I commitments for developing countries

INTRODUCTION

The ultimate objective of the UN Framework Convention on Climate Change (FCCC) is to achieve stabilization of greenhouse gas (GHG) concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system within a sufficient time-frame. In fact, limiting GHG emissions to specific levels now appears to be an internationally recognized objective.

In the Third Session of the Conference of the Parties (COP-3), a major shift in countries' attitude and commitment towards climate change is expected. The issue of 'legally binding commitments' towards reduction of GHG emissions by Annex I countries, which so far have been voluntary, is a very high priority item for the agenda for COP-3. However, some Annex I countries are unwilling to accept this without some similar binding commitments from the non-Annex I (developing) countries; their stand being contrary to the spirit of the Berlin Mandate.

Another argument being put forth is that adoption of legally-binding commitments by Annex I parties would imply undertaking certain policies and measures which will be detrimental not only to their own economies, but also to developing country trade partners.

Industrialized country citizens and policy-makers are being persuaded to recognize that binding emissions limits will impose significant costs, slow productivity growth, and thereby hinder the ability of Annex I firms to compete in international markets. This loss of competitiveness is believed to be reflected in declining exports, and a long-term movement of manufacturing capacity from the Annex I states to other countries (read non-Annex I), particularly in 'pollution-intensive' industries, shifting thousands of manufacturing jobs to developing countries (Jaffe *et al.* 1995). In fact, industry lobbying has already persuaded the US Senate to pass a non-binding resolution calling on the Clinton Administration not to sign any agreement that does not involve developing country commitments (Eco Newsletter, AGBM 7 1997). Japan's official position on quantified emission limitation and reduction objectives (QELROs), which are to be agreed at COP-3, also calls for commitments from non-Annex I countries. They are proposing five per cent as a base reduction rate for deciding a reduction target for each country, with the individual country's target to be 'differentiated by emission per gross domestic product (GDP), emission per capita, and population growth'.

It is quite evident that regarding the issue of 'legally binding commitments', some Annex I countries are using the dual-pronged approach to polarize the negotiations. This approach, on one hand, proclaims to both the developing and the developed world that their respective economies will suffer *vis-à-vis* the other as international trade and investment links may result in policies and measures taken by Annex I countries having trickle-down effects on non-parties (Eco Newsletter, AGBM 7 1997); and on the other hand calls for commitments from non-Annex I parties (developing world).

This paper aims to examine and analyse the claim that legally-binding commitments undertaken by Annex I Parties would result in adverse economic impacts on developing countries. *It is proposed to examine whether the magnitude of adverse negative impacts, if they exist, is reason enough to avoid commitments by Annex I countries.* This is accomplished through three case studies: the first analyses the case of the Indian economy which has a large industrial base; the second elaborates the case of Bangladesh which is heavily dependent on natural resources; and the third focuses on the oil exporting economy of Indonesia.

TRADITIONAL THEORY

The traditional, classical, and neo-classical theories of trade explain trade in terms of the benefits accruing to all the participants engaging in trade. These benefits arise from the different efficiencies in the production of goods in different countries. Instead of each country producing everything, the countries choose to specialize according to their *comparative advantages*, and costs are thereby minimized, i.e., the country with the lowest marginal production cost enjoys a *comparative advantage* and will produce the goods for domestic and foreign consumption. Trade and specialization will result in a higher total production and the countries will have a greater joint 'pie' to share. Each country will improve its welfare by increasing either producer or consumer surplus.

> ...Nations have struggled to adapt their notions of sovereignty and governance to the realities of economic interdependence; that is, to the coupling of local and national economies with a global system ... Now they (nations) must struggle with an even more complex imperative: economic interdependence has become enmeshed with ecological interdependence and the systems are now one. Their impact on each other is enormous, growing rapidly, and could soon be decisive in defining our future. This is the new reality of the late 20th century. It may well become the dominant reality of the new millennium ... Nowhere, is this new reality more evident than in trade and the natural environment (MacNeill 1992).

A recent Organization for Economic Cooperation and Development (OECD) paper declared that:

> ...Trade and environment policies should be seen as being mutually supportive rather than in terms of conflicting interests. Trade spurs

> economic growth and helps provide the technical and financial resources to protect the environment, while a healthy environment provides the ecological and natural resources needed to underpin long-run growth stimulated by trade. ...it is therefore important that trade policies are sensitive to environmental concerns and that environmental policies take account of effects on trade. Unlike sustainable development, free-trade is not an end in itself ... (OECD 1991).

Legally-binding obligations to reduce emissions would lead the Annex I countries to go in for conservation-oriented, energy-efficient measures. These mitigation measures would stimulate diversification and growth in world trade. In fact, according to John P Holdren, professor of technology and public policy at Harvard University, global warming is the 'most demanding driver' for change in energy research and development.

RECENT DEBATE

Transmission of economic impacts of legally-imposed CO_2 constraints in the developed countries on non-Annex I economies can be classified into five broad areas of concern.

1. The impact of reduced economic growth in the developed countries. This would visibly result in a setback to the exports of the developing world.
2. The increase in cost of the energy inputs and a cap on the carbon content/emitted would result in an increase in the price of the commodities for final consumption as well as intermediaries. This would increase the price of the exports of the developed world, across the board. As long as the commodities affected are essential to the developing world, their imports would be more expensive.
3. To protect the competitiveness of the domestic industry, the developed countries in all likelihood would set comparable norms (carbon content limits or tax) for imports. This would, in turn, affect the price of exports of the developing countries.
4. There would not only be a decrease in investment in the developed countries with stringent environmental norms, but a shift in the location of industries would take place to those developing countries where these norms are not so strict. This is the 'dirty industry'/'pollution haven' hypothesis.
5. There would be a direct effect on the fuel/energy markets. As there is not much North-South trade in coal and gas, the dominant impact would be upon the oil market. The direction of this impact, however, is uncertain. Nonetheless, this effect is of great importance to the Organization of Petroleum Exporting Countries (OPEC) countries, and may well turn out to be an issue of contention in the post-Kyoto phase.

Regarding the link between trade and the economic impacts of Annex I country actions on non-Annex I parties, if Annex I agree to accede to 'legally binding commitments' for reduction of their emissions, the literature does present some interesting arguments.[1]

According to the standard theory of international trade, the real effects of regulation (or any other policy change) on competitiveness can be measured by identifying the effect that the policy would have on net exports holding real wages and exchange rate constant, i.e., *ceteris paribus.* Environmental regulations effect costs of production either through the industries'/firm's own expenditure on pollution reduction, or through the higher prices it must pay for factors of production that are affected by regulation. But, environmental regulations can also reduce costs for industries/firms by lowering input prices or by increasing the productivity of their inputs (Jaffe *et al.* 1995).

> In any case, the degree to which domestic regulatory costs (and benefits) affect trade will depend also on the magnitude of the costs (and benefits) that other countries impose on the firms operating within their borders. Likewise, other nations' policies will also affect the investment decisions of their indigenous firms and of foreign firms, as well. Any change in investment patterns that does occur ultimately affects trade flows also, and both trade and investment effects interact with exchange rates (Jaffe *et al.* 1995).

Pasurka Jr (1984) and Wyckoff and Roop (1994) have shown that not only is the impact of environmental regulation imposed by developed countries on their own economies not significant, its effect on the economies of the developing countries is also marginal. Using an input-output framework, Pasurka Jr investigated the impact that environmental protection costs had on prices in the US in 1977. He found that, with the imposition of environmental protection costs, the projected total price increases for individual industries range from 0.12% to 6.58%. His results indicate the typical impact likely to occur across industries, and also that the average impact on prices is modest.

Wyckoff and Roop (1994) use an input-output framework and estimated the amount of carbon embodied in imports of manufactured products to six of the largest OECD countries—Canada, France, Germany, Japan, UK, and the US. The estimates reveal that a significant amount, about 13% of the total carbon emissions of these countries, is embodied in manufacturing imports. This paper is very relevant to the current resurgence of interest in the trade-environment interface, due to its implications for the ongoing climate change issue of economic impacts of Annex I countries on non-Annex I countries. The paper clearly indicates that the bulk of the carbon-intensive trade of Annex I countries is intra-Annex I.

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[1] This paper addresses transmission of economic impacts of Annex I countries on non-Annex I economies. This is not to undermine the importance of economic impacts for the developed countries.

Recently, World Resources Institute (WRI) examined 162 different simulations using sixteen widely-used economic models. They found that just eight basic assumptions account for more than 80% of the differences in the models' predictions, determining whether their economic results are large or small, positive or negative. As a result of this heavy reliance on set assumptions, the authors in the report unambiguously say that:

> People need not accept all the best-case or all the worst-case assumptions. It is more reasonable to predict that with sensible public policies and international cooperation, carbon dioxide emissions can be reduced with minimal impacts on the economy (Repetto, Austin 1997).

Further, these models do not examine developing countries in detail; in fact, this group of countries are treated as a residual in such modelling exercises. It is in this context that this paper seeks to analyse the debate on economic impacts of commitments of Annex I on developing countries. In particular, this premise for avoiding any commitments by Annex I countries to reduce emissions is reviewed.

DEVELOPING COUNTRY PERSPECTIVE

The developing countries are not homogenous, and hence the impacts on their economies will also vary depending on the level of economic development, the diversity of the economy. On one end of the spectrum are the East-Asian Tigers, which comprise countries like South Korea, which is on the verge of joining OECD. Rapidly growing economies with countries like India, China, Brazil, and Mexico form another group. A characteristic of these countries is that, over the years, they have developed a sound industrial base. Also, from being primary product exporters, they have made the manufacturing base as their export flagship. Small countries like Bangladesh who are yet to develop a sound industrial base, and are still heavily dependent upon a limited basket of commodities for their exports, and imports, constitute another group. Another characteristic of this group is reliance on imports of capital-intensive heavy industries. An important point of similarity of these three groups is that all are oil importers. Finally, there are countries like Indonesia and Venezuela, which are oil exporters.

Therefore, the economic impacts of Annex I's carbon reduction would not affect the entire South in a similar manner. What this means is that in an analysis of the economic impacts of Annex I Parties' commitment to reduce carbon emissions, on the non-Annex I countries, these economic impacts would vary along the lines drawn above. Hence, a policy conclusion encompassing the entire South would not be the right kind of prescription.

In the following analysis there is a segregation along the above lines. Three country papers, that of India, Bangladesh, and Indonesia are presented.

CASE STUDY FOR INDIA

Background

India's development strategy in the period soon after independence could be characterized by a policy of planned economic development accompanied by import substituting industrialization programme. As a result, capacity creation too concentrated on self-sufficiency, rather than the creation of the ability to pay for imports through export promotion. Exports were consequently viewed as a means for vent of surplus. Such an emphasis was one of the reasons for low export growth between the 1950s and the late 1980s. During this period, the value of world exports grew by 35 times, while in India, it grew by only about seven times. In 1950, India's share in world exports amounted to just over 2%. In fact, this share dropped even further in 1960 and 1970, accounting for 1.2% and 0.6 % respectively. In 1980, this share declined further to 0.4%. It was only in the late 1980s, when exports began to be emphasized in the process of globalization that increases in export growth became discernible. This was primarily because the import substitution policy was reversed in 1991 in the wake of liberalization, after almost four decades of planned development and economic growth with primary emphasis on import substituting industrialization. Amongst the first things to be dismantled in these reforms was export pessimism. In fact, trade and industrial liberalization were the major components of this reform package.

In 1960/61, agriculture and allied products accounted for approximately 45% of the total exports. Since then, the importance of this sector has declined consistently, accounting for 32% in the early 1970s and 30% in the early 1980s. At the beginning of the 1990s, the share of the agriculture sector dropped to less than 20%, and in 1994/95, the share stood at 16%. Concomitant with this was the increase in the share of exports of manufactured products, which rose from 45% in 1960/61 to over 50% in 1970/71 and 56% in the early 1980s. At the beginning of this decade, the contribution of manufactured exports was about 73% and increased to 78% in 1994/95. Among the products which propelled this growth are textiles, leather manufactures, engineering goods, chemicals and dyes, and gems and jewellery.

On the imports front, in 1960/61, raw materials and intermediate manufactures had the largest share, followed by capital goods and food and live animals. The shares in India's imports were 47%, 32%, and 19% respectively. In the same year, import of petroleum and oil lubricants accounted for 6% of the total imports. Since then, the share of this commodity in overall imports has increased steadily, with the exception of the period of the oil price shock. The imports of all the other commodities have declined, more or less, over the years. The imports of raw material and intermediate manufactures have risen to 54% in 1970/71 and were at a high of 78% in 1980/81. This can largely be due to the imports of petroleum and oil lubricants, which is included within this commodity group. The imports of food and live animals were 15% in 1970/71 and only 3% in 1980/81. The imports of capital and capital goods reached a low of 15% in 1980/81 and since then have gained a fair margin. They were 24% in 1990/91 and are 21% in 1995/96.

Table 1. *Exports and imports of India: select commodities (1995/96)*

India's exports (%)		India's imports (%)	
Textiles and garments	23	Non-electrical machinery	10
Machinery and transport equipment	6	Organic chemicals	5
Leather and products	6	Iron and steel	4
Chemicals	2	Transport equipment	3
Animals and vegetable products	18	Textile yarn fabrics, made-up articles	1
Metals and minerals	9	Electrical machinery	1
Product of chemical, plastic, and allied industries	8	Pulp and waste paper	1
Carpets, jute, and paper products	5	Dyeing, tanning, and colouring material	1
Primary energy products	2	Paper board and manufactures	0.5
Miscellaneous products	3	Pearls (precious) and semiprecious stones	6
Gems and jewelry	17	Chemical and related products	7
Other commodities	3	Goods	14
		Energy products	23
		Metals, minerals, and products	10
		Wood and paper products	2
		Cotton, jute, and rubber	2
		Animal and vegetable products	4
		Other commodities	7

In 1994/95, India's exports and imports were 8.74% and 9.38%, respectively, of our GDP (at current prices). For the years 1995/96 (provisional), the exports and imports of principal commodities (for India) are presented in Table 1. From this table, it is seen that textiles and garments, animal and vegetable products, gems and jewellery, and leather and products constitute the chief exports. The imports basket primarily contains energy products, metals, minerals and products, machinery (electrical and non-electrical) and transport equipments, paper and paper products, chemicals, and iron & steel. For the same year, the exports constituted 86.27 % of the imports.

The RBI Report on Currency and Finance (RBI 1997) states that the direction of Indian trade remains unchanged with the OECD[2] countries continuing to constitute both the principal market for Indian exports apart from being a major source of Indian imports, for the fiscal year 1995/96. The shares for India's major trading partners is shown in the graph below (Figure 1). The figure also presents the direction of India's trade with select countries/blocs.

With trade liberalization, OECD accounts for 54% of the trade and developing countries 26.6 % of the trade (RBI 1997). Tables 2 and 3 document the major destinations of select Indian exports and imports for 1995/96 (P). The US, Germany, and Japan are the prime individual trading partners for India.

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[2] The OECD group includes Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, The Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and the US.

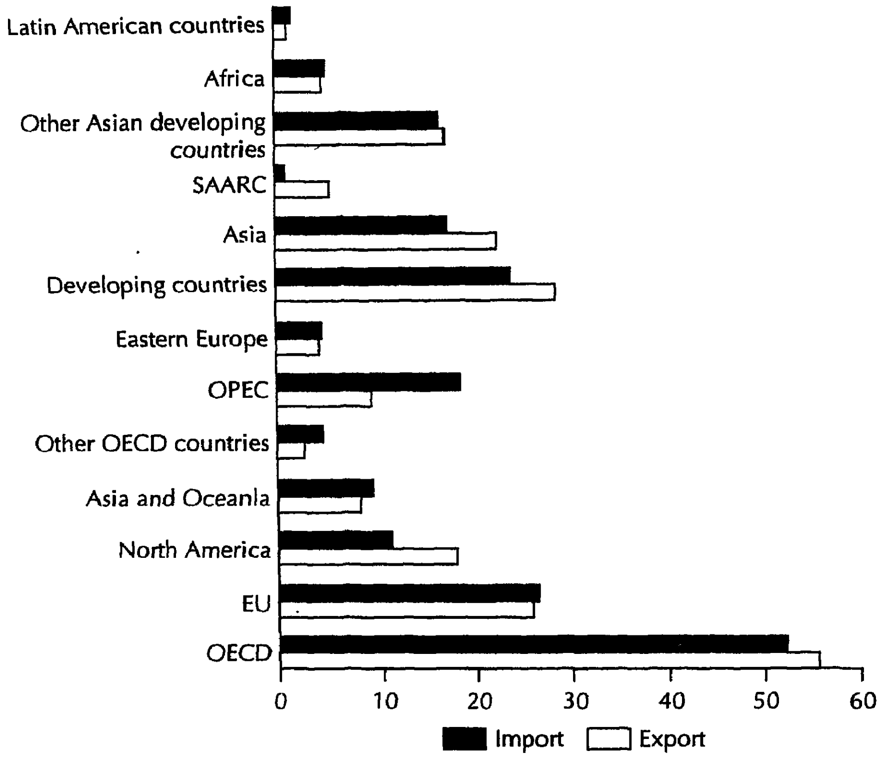


Figure 1. *Direction of India's foreign trade, 1995/96 (P) – %*

Table 2. *Top three countries for export of select Indian commodities (%)*

Export	Three major trading partners (percentage share)		
Leather and leather manufactures	Germany 22.42	US 17.1	Italy 11.94
Chemicals and allied products	US 12.18	USSR 8.71	Germany 8.14
Engineering goods	US 14.01	UAE 6.64	Singapore 6.27
Cotton yarn, fabrics, made-ups, etc.	US 11.65	Bangladesh 11.38	UK 10.43
Readymade garments	US 32.9	Germany 11.56	UK 9.66

Methodology and results

This paper examines the impact of commitments by Annex I countries on developing countries through international trade. A non-trade related effect of commitments by

Table 3. *Direction of select imports of India, 1995/96*

Imported commodity	Three major trading partners (percentage share)		
Organic chemicals	USA 15.4	Japan 10.0	China 8.4
Iron and steel	Germany 18.4	Japan 15.4	Italy 6.5
Transport equipment	US 35.9	Japan 22.0	Germany 10.1
Textile yarn fabrics, made-up articles	South Korea 14.7	Taiwan 13.2	China 9.7
Electrical machinery	Japan 16.7	US 16.6	Germany 14.6
Pulp and waste paper	US 29.4	Canada 20.4	Saudi Arabia 4.7
Dyeing, tanning, and colouring material	Singapore 18.4	Germany 13.7	US 8.3
Paper board and manufactures	UK 27.6	Germany 11.3	US 8.7
Non-electrical machinery	Germany 23.2	Japan 13.6	US 14.3

Source. CMIE (1996)

Annex I countries would be the migration of carbon intensive industries to non-Annex I economies. The issue of migration of dirty industry has not been addressed. In case Annex I countries agree to a legally binding target, they are likely to adopt economic instruments (for example, a carbon tax) and/or some form of standard setting to achieve the target. Standards on the carbon intensity of goods may be set for domestically produced and imported goods. Enforcing the standard for imported goods will entail practical problems in terms of assessing and monitoring the carbon content. This task may not be easy to administer at the domestic level as well. In this study it is assumed that the Annex I country imposes a carbon tax in order to achieve its target emissions level.

Several complex interactions are possible with Annex I countries agreeing to legally binding targets. In this study, a simplified approach has been adopted to analyse the impact of legally binding commitments by developed country parties, on developing countries. A case study of bilateral trade between India and the US has been considered to provide an indication of the direction such an impact is likely to have. The rationale for selecting the US is evident from Tables 2 and 3, which indicates that the US is clearly one of the most important partners in India's trade. It is important to highlight that this is a partial analysis and it addresses only one part of a complex web of interactions; however, this part is important in the system.

The Annex I parties can adopt various policies and measures to meet their commitments to reduce emissions. Technological innovation to reduce energy consumption is one such measure. This, however, is a long-term solution. In the immediate future, measures such as carbon tax seem more likely. Levying such a tax will necessarily increase the cost of inputs, which in turn will result in a higher price of the product. A corollary to this will be imposition of a comparable tariff on imports of the same product, to provide effective protection to domestic industry. This obviously raises the question that production processes of imports may have a different (possibly higher) carbon intensity and that they should be subject to a tax rate different from the domestic economy. However, transaction costs of implementing such a regime may be very high, necessitating a tax regime similar to that of the domestic economy.

The methodology is as follows:

- identification of major commodities traded between the two countries,
- assumptions, regarding the carbon tax that may be levied, in the post-Kyoto timeframe,
- impact of the carbon tax on the price of the commodities,
- application of price elasticity for both imports and exports of India, to determine the impact of the probable carbon tax on the value of goods traded, and
- determination of the affect of the likely change in trade volumes on the GDP of the country.

Identification of major commodities traded: US–India

Exports

Four major commodity groups are selected to analyse the impact of imposition of a hypothetical carbon tax by the US. The selection criteria are chiefly determined by the importance of these commodities in the Indo-US trade, carbon intensity of the goods as well as the estimates available for price elasticity of Indian exports. The shortlisted commodity groupings are: textiles and garments, machinery and transport equipment, leather and leather products, and chemicals.

These four commodity groups have a share of 36% in total exports of India. Trade in these with the US constitutes 18% of the total exports of these four commodities, and is 37% of the overall exports to the US.

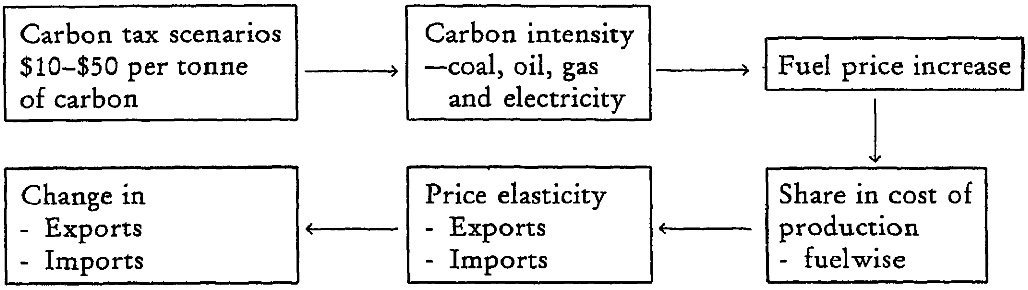
Imports

The selection of commodities imported from the US is also based on criteria similar to that of exports. The short listed nine commodity groups are: pulp and waste paper, dyeing and colouring material, organic chemicals, textile, yarn and fabrics, iron and steel, paper and board, electrical machinery, non-electrical machinery, and transport equipment.

These nine commodity groups have a share of 25.5% in total imports of India. Further, trade in these with the US constitutes 15.6% of the total imports of these nine commodities, and is 37% of the overall imports from the US.

Carbon tax scenarios

An examination of the carbon tax levied by some Nordic countries shows that it averages to about US $30 per tonne of fuel. A range of scenarios for carbon tax ranging from US $10/t C to US $50/t C is considered. These are translated into an equivalent for fuels, based on the carbon content of fuels. Further, the concomitant percentage increase in the price of fuels due to the carbon tax is estimated. Based on input-output data for the US economy, the share of different types of energy (namely, coal, oil, gas, and electricity) in the cost of production was estimated. The percentage change in commodity prices is calculated as the product of the share of different types of energy inputs in the cost of production and the percentage increase in the fuel price due to imposition of the carbon tax.



Methodology for computing impact on international trade

It is assumed that due to imposition of a carbon tax, the US will structure a mechanism to effect a tariff on imports by the US to provide a level playing field for its domestic industries. The price of exports to the US will increase by the imposition of these tariffs. The tariff is assumed to be equal to the percentage increase in the cost of production of the commodity.

Impact on exports and imports of India

The final impact on the value of imports and exports is captured by computing the increase in price of a commodity and its effect on the demand through the price elasticity of each commodity group. The results show that the value of India's exports of the four select commodities to the US will drop between 0.6% to 3.1% for the carbon tax range of $10–$50/t C. This will obviously imply a much lower percentage of the total exports to the US, as the other commodity groups are not carbon intensive.

Similarly, the value of imports of the nine selected commodity groups from the US is also expected to decline from 0.6% to 3.0%, due to a lower demand emanating from the hike in prices due to the carbon tax of the commodities. These results have been presented in Tables 4 and 5.

Ideally, the above analysis should capture other impacts on volumes traded, such as, the income effect and the production effect. This analysis would require a detailed model of the Indian and US economies using the input-output tables, or developing system dynamics/computable general equilibrium models as well as a trade module to capture the likely shifts in the direction of trade. Although, there are quite a few such models in existence (Repetto, Austin 1997), which have shown a wide variation in results as far as impacts on the economies are concerned, these are not specific to developing countries. In most cases, developing countries are treated as residual. This analysis is limited to a simple, partial, quantitative analysis rather than a detailed modelling exercise, since the objective is to diagnose whether there is any basis for the claim that legally binding commitments of Annex I parties will be detrimental to the non-Annex I countries.

Results

An increase in the price of exports to the US works through the elasticity of export demand for India, and the value of exports fall resulting in a negative impact on the Indian GDP. With a carbon tax, imports from the US become more expensive. Working through the import elasticity of demand, the value of imports will decline, thereby, increasing GDP. Recognizing the fact that this would imply constrained availability of certain inputs in the Indian economy there could be significant second-order impacts which could impact GDP negatively. The direction of the impacts of imports is therefore uncertain, but it is unlikely that the second-order negative impacts would exceed the first-order impacts.

Of the total exports from India the share of energy-intensive and hence, carbon-intensive goods is about 36%. The total exports to the OECD is about 56%. The export of carbon-intensive goods to the OECD accounts for about 20% of the total exports. Therefore, based on the results of the analysis for bilateral trade between India and the US, it can be extrapolated that the reduction in the total volume of exports would be in the range of Rs 101 to 522 crore in 1995/96. This reduction is less than a 0.05% reduction in GDP for a US $50 per tonne of carbon tax.

For imports, as the direction of the net impacts cannot be ascertained due to the partial approach adopted here, the worst possible scenario is the case where the import elasticity is zero. This would imply that the value of imports increases proportionate to the increase in the price of imports. This would result in a loss in GDP of 0.03% for a carbon tax of US $50 per tonne of carbon. However, the import elasticities indicate that the most inelastic import demand is for non-electrical machinery and transport equipment (–0.61).

Results of the case study for India clearly reveal that the loss in GDP on account of reduced exports revenue will be about 0.05% for US $50 per tonne of carbon tax. Assuming completely price inelastic imports the loss in GDP will be on the order of 0.03% of GDP. These losses are in no way significant enough to warrant inaction on reduction of carbon emissions.

Table 4. *India's select exports to the US*

Commodity groups	Price elasticity of demand	Exports to US in 1995/96 (P) (million US $)	Total exports of India in 1995/96 (P) (million US $)	Change in value for tax scenarios: $10/t C	Change in value for tax scenarios: $20/t C	Change in value for tax scenarios: $30/t C	Change in value for tax scenarios: $50/t C
Textile and garments	−2.74	1135	5423	−30.91	−61.82	−92.74	−154.56
Machinery and transport equipment	−0.55	140	1377	−0.84	−1.68	−2.52	−4.20
Leather and products	−0.27	233	1338	−0.77	−1.54	−2.31	−3.86
Chemicals	−0.63	20	373	−0.43	−0.87	−1.30	−2.16
Total of above	—	1528	8511	−32.95	−65.91	−98.97	−164.78
Total exports of all commodities		4179	24056				
Percentage change in value of India's select exports (as above) to the US: post tax scenario				−0.6%	−1.2%	−1.8%	−3.1%

Note. These figures are provisional (P) figures and are for the period April–January 1995/96; the conversion rate used is Rs 35 per US$.

Table 5. *India's select imports from the US*

Commodity groups	Price elasticity of demand	Imports from US in 1995/96 (P) (million US $)	Total imports of India in 1995/96 (P) (million US $)	Change in value for tax scenarios: $10/t C	Change in value for tax scenarios: $20/t C	Change in value for tax scenarios: $30/t C	Change in value for tax scenarios: $50/t C
Pulp and waste paper	−2.58	61	208	−3.29	−6.57	−9.86	−16.44
Dyeing and colouring material	−1.75	12	141	−0.70	−1.40	−2.09	−3.49
Organic chemicals	−1.75	204	1327	−12.20	−24.39	−36.59	−60.99
Textile yarns and fabrics	−2.22	11	282	−0.29	−0.52	−0.87	−1.45
Iron and steel	−1.45	49	1056	−2.21	−4.52	−6.63	−11.06
Paper and board	−0.73	11	130	−0.12	−0.34	−0.52	−0.86
Electrical machinery	−1.27	49	296	−0.71	−1.43	−2.14	−3.56
Non-electrical machinery	−0.61	404	2817	−2.70	−5.40	−8.09	−13.49
Transport equipment	−0.61	309	859	−0.94	−1.89	−2.83	−4.72
Total of above		1110	7117	−23.16	−46.46	−69.62	−116.06
Total imports of all commodities		3028	27885				
Percentage change in value of India's select Imports (as above) from the US: post-tax scenario				−0.6%	−1.2%	−1.8%	−3.0%

Note. 1) These figures are provisional (P) figures and are for the period April–January 1995/96.
2) The conversion rate used is (as per CMIE, 1996)

Source. CMIE (1996); Patra, Ranjan (1992).

CASE STUDY FOR INDONESIA

Introduction

The underlying key issue concerning efforts to prevent undesired climate change effects due to increasing GHG accumulation in the atmosphere is the control on the rate of anthropogenic GHG emission.

Regarding the issue, Article 4, paragraph 2 of the UN FCCC stipulates that

> The developed country Parties and other Parties included in annex I commit themselves specifically as provided for in the following: (a) Each of these Parties shall adopt national policies and take corresponding measures on mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases and protecting and enhancing its greenhouse gas sinks and reservoirs.[3]

One possible policy action, based on the principle of 'polluters pay', is applying some form of environmental tax. In the case of GHG emission, considering that a significant share of such emission originated from the use of fossil fuels, the most widely considered environmental tax is the carbon tax.

This paper attempts to investigate what could be the impacts to the economy of the developing countries if, in the efforts for limiting GHG emissions, industrially developed countries widely opted for implementing carbon tax as a policy measure. The scope of the study is limited to the analysis of the possible impacts on the economic development of Indonesia.

SALIENT FEATURES OF INDUSTRIAL DEVELOPMENT

The development of the industrial sector of Indonesia, particularly the modern manufacturing sector, has taken place mainly by way of importing technological systems, either acquired as technological prescriptions or as capital goods. A significant fraction of intermediate inputs to the manufacturing sector is also supplied through imports.

With the described industrial development process, any growth in demand for manufactured goods, whether for domestic market or for export market, will drive demand for import of technology, in the form of capital goods, technical services, and intermediate goods. Practically, all the imported technological systems are originated from industrially developed countries, mainly North America, Western Europe, and Japan.

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[3] *Undang-Undang Republik Indonesia Nomor 6 Tahun 1994 tentang Pengesahan United Nations Framework Convention on Climate Change (Konvensi Kerangka Perserikatan Banga-Bangsa Mengenai Perubahan Iklim)*, Government of Indonesia, 1 August 1994.

In view of the above, to sustain the operation and the growth of the manufacturing sector, the availability of foreign exchange is a necessity. The economy is, therefore, highly dependent on foreign exchange revenue from export.

The need for foreign exchange is generated from export of oil and gas (OG), and non-OG commodities, namely agricultural and wood products, and manufactured goods. Although, in the past ten years, the share of non-OG commodities in the export revenue has always been higher than the oil and gas commodities, the import needs to support the non-OG sectors, particularly the manufacturing sector, has always been higher than its export revenue. The development of infrastructure and the power sector has also taken place with considerable technological inputs from abroad, and the corresponding requirement for foreign exchange is provided through loans from multilateral funding agencies. The overall result is that the country has always been experiencing deficits in its balance of payment that tend to grow, and there is also an upward trend of the country's foreign debt.

In view of the above, there are a set of critical factors of the dynamics of the economic development of Indonesia, that are strongly linked to the mechanisms and processes governing the availability of foreign exchange reserve. These are:

- net foreign exchange that the country can earn from international trade;
- the level of foreign loan that the country can manage to acquire; and
- the dependability of the economy on imported technology.

THE IMPACT OF CARBON TAX

In terms of the global efforts in controlling the rate of GHG emission, the implementation of carbon tax can be seen as an effective approach. Properly managed, it may transmit the right signal to the market to adjust towards a condition whereby production activities will take place along a path that is less intensive with respect to GHG emission.[4]

There may be, however, other aspects of undertaking such strategy that could impose some disadvantages to the economy of the developing countries.

If the implementation of carbon tax results in higher prices of capital goods and other commodities that constitute strategic inputs to the industrial development of developing countries, then there will be (a) higher expenditure for the import of such goods to the corresponding developing countries, and (b) production costs in those countries will be pushed upwards, leading towards lower competitive position of produced commodities.

In addition, if the said imported goods are used in a production system that utilizes carbon-intensive fossil fuel, and the produced commodities are exported to countries applying carbon tax, there may be barriers to the commodities. Some indirect carbon tax may be imposed by the importing countries. This will further reduce the price competitiveness of the commodities.

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[4] Roodman R M. 1997. *Getting the Signals Right: Tax Reform to Protect the Environment and Economy*, Worldwatch Paper 134 (May).

The total effect will lead to the formation of positive feedback loops (amplifying feedback loops) that have degrading effect towards foreign exchange earning. Furthermore, due to the technology dependency, such a situation may impose significant constraints to the industrial (economic) development of the country, hence some depressive effect to the GDP. It may also lead to higher demand for foreign exchange loans, and add to factors that aggravate the balance of payment situation.

To investigate such possible effects, an analysis was undertaken, by way of simulation, using a system dynamics model describing the energy-economy linkages of Indonesia, to represent a developing country that has the benefit of being a net oil exporting country. Some limited environmental features are also included in the model structure. A diagrammatic overview, describing the main structural components of the model is given in Figure 2. A more elaborate description of the model has been presented elsewhere.[5,6]

In undertaking the simulation, it is assumed that the effect of imposing carbon tax will cost additional 3% to the country's expenditure for import. The corresponding scenario is designated as *price scenario*. If the exported goods of the country are subjected to carbon tax at the receiving country, because in the process of producing the goods some carbon containing fuel is used, it is assumed that the overall effect is a depression in the export demand to the country. The said effect is assumed to occur as a result of some loss in price competitiveness of the exported goods. The corresponding scenario is designated as *export scenario*. It is assumed in both the price and export scenarios that demand for foreign exchange loan can always be satisfied. Such may not always be the case. A third scenario is generated, to see the effects if there are constraints to the availability of foreign exchange loan. The corresponding scenario is designated as *loan scenario*. Table 6 summarizes the parameters defining each of the four scenarios. It must be noted that the scenarios are not mutually exclusive. As one goes from the base scenario to the loan scenario, each succeeding scenario has additive effect on its preceding scenario.

The export and import price growth rates indicated in Table 1 correspond to the defined export and import price index trajectories shown graphically in Figure 3.

The results of the simulation that are most relevant for this analysis are shown in Figures 4–10.

Export of industrial commodities

The trajectory of the potential demand for export of industrial goods (designated as export target) in each of the scenarios, corresponding to the defined export growth rates given in Table 1, is shown in Figure 4.

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[5] Centre for Research on Energy - Institut Teknologi Bandung. 1997. *ALGAS Project, Task C3 Report: Development of CERI curves for the Energy, Transport and Industry Sectors, Indonesia Country Study Component.*

[6] Centre for Research on Energy - Institut Teknologi Bandung. *Efficiency-oriented and Environmentally-Constrained Alternative Energy Strategy Scenarios, Indonesia Country Study*, prepared by for APDC-ESCAP/Pace-e Programme.

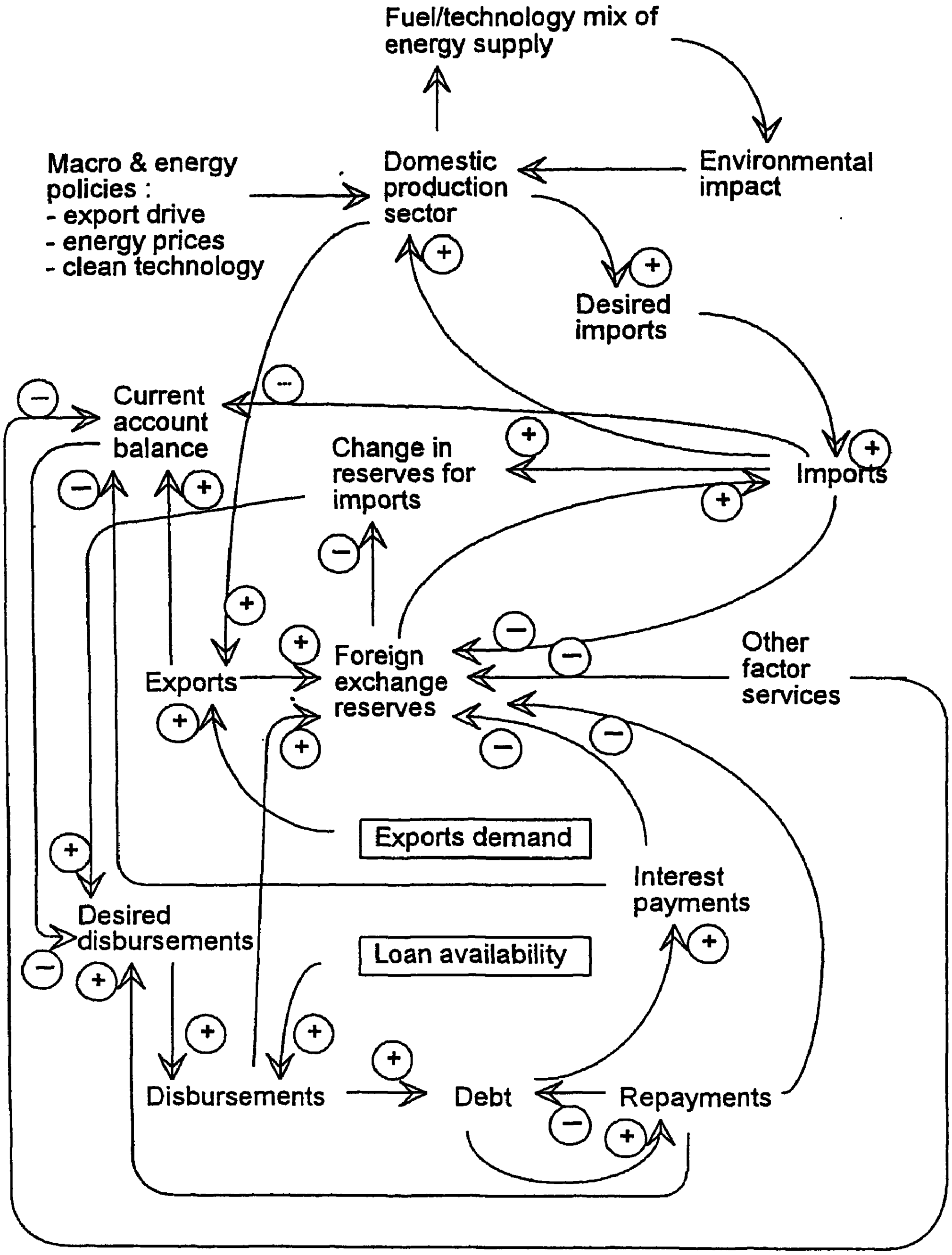

Figure 2. *Diagrammatic description of the structure of the model, delineating the cause-effect relationships amongst the major system components*

Table 6. *Key parameters of the scenarios*

Parameters	Parameter values			
	Base (*) scenario	Price scenario	Export scenario	Loan scenario
Export demand growth rate (1990–2020)				
Non-energy industry (%/year)	8.63	8.63	6.62	6.62
Agriculture (%/year)	8.22	8.22	7.15	7.15
Oil (%/year)	2	2	2	2
Natural gas (%/year)	5	5	5	5
Coal (%/year)	5	5	5	5
Export price growth rate (1990–2020)	4.25	4.25	4.25	4.25
Import price				
Growth rate prior to year 2000 (%/year)	5.93	5.93	5.93	5.93
After year 2000 (%/year)	5.93	3% higher than the base scenario		
Loan availability(**)	1	1	1	0.5

(*) The base scenario is defined as the scenario where there is no carbon tax applied to fossil fuel.
(**) A value of 1 indicates that any level of desired loan can be fully satisfied; while a value of 0.5 indicates that only 50% of the desired loan can be satisfied.

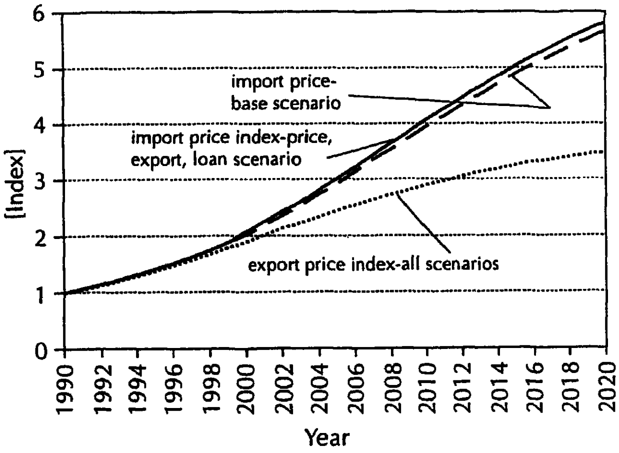

Figure 3. *Export vs. import price index*

As can be seen from Figure 4, the export targets for the base and price scenarios are set to be the same. The imposition of carbon tax in the developed countries does not show any significant effect. Despite the increase in import prices, the export target can always be satisfied.

In the export and loan scenarios, the export targets are also set at equal growth rates, but are less than the growth rates of the two previous scenarios. The reason for assigning lower growth rates is already explained previously; i.e. loss of price com-

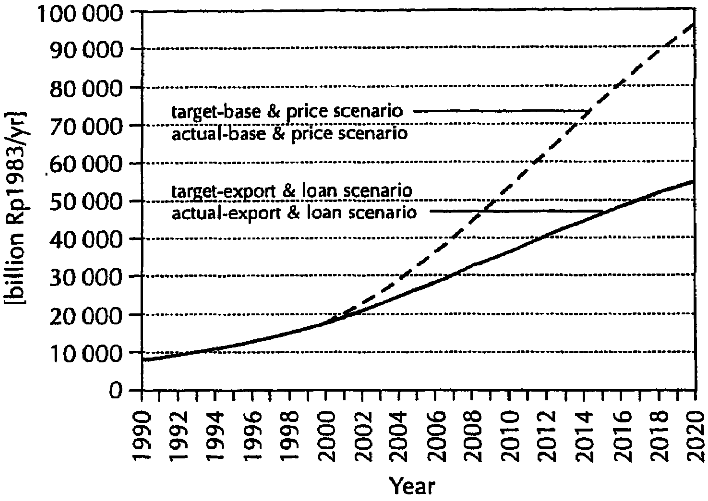

Figure 4. *Export of industrial commodities*

petitiveness because the exported goods are subjected to carbon tax at the receiving country. As with the case with the two previous scenarios, the export targets are always satisfied.

The described system responses indicate that the institution of carbon tax in the developed countries may have to be taken as an issue of concern to developing countries, if it is carried out to the extent that it effects the price competitiveness of exported goods from developing countries.

Import of industrial goods

The projected developments in imports of industrial commodities of the various scenarios are compared in Figure 5.

By inspection of the patterns shown in Figure 5, one can conclude that the institution of carbon tax in developed countries has a depressive effect on the imports of goods originated from those countries.

The observed effect is a consequence of the previously described developments in the export of industrial goods from developing countries, since the ability to satisfy demand for import depends on the availability of foreign exchange reserve, which is a function of the revenues from exports.

The extent of the depressive effect on the ability to satisfy demand for import of industrial goods from developed countries, if carbon tax were instituted, depends on the magnitude of the effect that such action has on the price increase of the imported goods and on the decrease in the ability to export due to loss in price competitiveness of the exported goods.

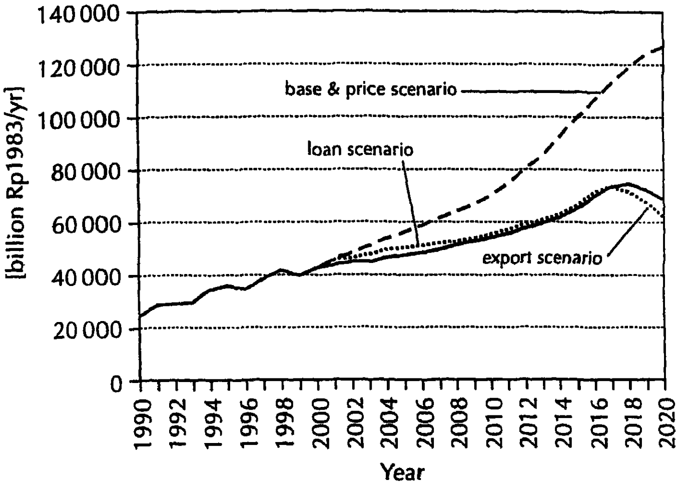

Figure 5. *Import of industrial commodities*

Capital stock

Since the country is technology dependent to developed countries, the ability to satisfy import demand dictates the rate of capital investment; hence the development in the capital stock of the country. This is shown in Figure 6.

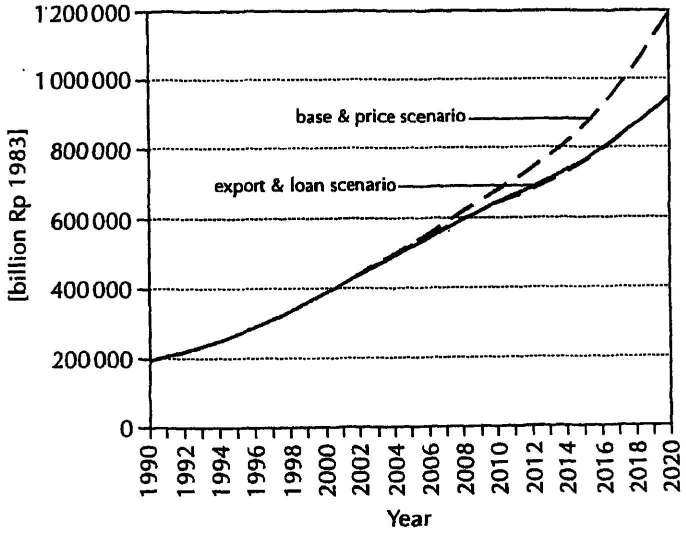

Figure 6. *Capital stock (industry)*

The pattern of development in capital stock, therefore, follows the pattern of the development in the ability to satisfy demand for import which, in turn, is influenced by the formation of foreign exchange reserve through export.

Gross domestic product

The aggregated impact to the economy, as represented by the developments in GDP per capita is shown in Figure 7.

With the assumption that the institution of carbon tax in developed countries will result in three per cent increase in prices of imported industrial goods from those countries, there is a slight depression in GDP per capita.

If, however, the imposed carbon tax has significant effect in lowering the price competitiveness of exported goods, and hence the export revenue, as is shown in the export scenario, there will be considerable depressive effect to the rate of growth of the GDP per capita.

Debt and current account balance

As was pointed out in the beginning of this paper, the availability of foreign exchange reserve is a determinant to sustaining the economic development of Indonesia.

Although Indonesia is a net oil and gas exporting country, and the export of these commodities contribute substantially to the formation of foreign exchange reserve, the pace of the economic development has taken place such that, in general, the country has always been experiencing deficits in its current account balance.

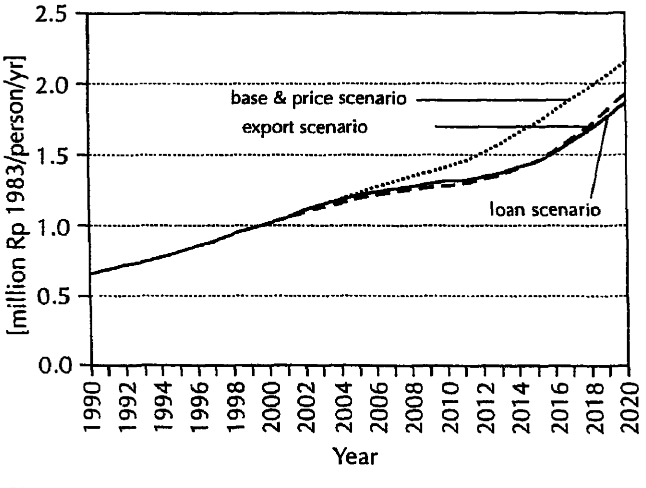

Figure 7. *GDP per capita*

The need to import technological goods and services to undertake industrial development and to build the country's infrastructure, has required the supply of foreign exchange at rates surpassing the rate of foreign exchange generation from trade balance surpluses. The rate of foreign investment has not been able to compensate significantly to the foreign exchange deficits. This has resulted in the dependency on foreign loans.

Considering the above, it is also important to see how carbon tax would effect the development of the country's debt and current account balance situation. The scenarios concerning these two elements are shown in Figures 8 and 9.

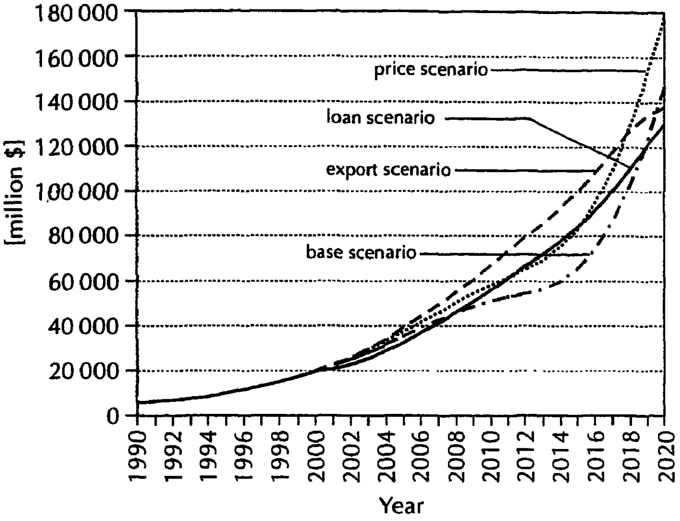

Figure 8. *Debt*

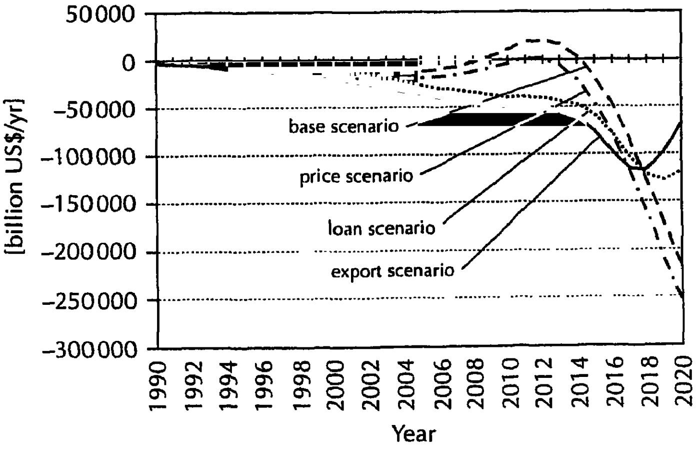

Figure 9. *Current account balance*

One can see that the institution of carbon tax in developed countries can have significant effects in deteriorating the debt and current account balance situation of the country.

CONCLUDING NOTES

The analysis on the possible impacts of instituting carbon tax in industrially developed countries to the economy of Indonesia, an oil exporting country, having the common characteristic features of the developing countries, indicates the following:

> In general, the institution of carbon tax in developed countries may have certain disadvantageous effects on the economy of the developing countries; the magnitude of the impact generally seems to be little.
>
> However, the extent of the undesired impact could be significant, depending on the degree of technology dependency of the country to the industrially developed countries and the ability to acquire foreign exchange from exports.
>
> Since the institution of carbon tax may be an effective means for global GHG emission reduction, especially those that are originated from the industrially developed countries, a 'soft path' to the implementation of carbon tax is worth considering, i.e., an approach that can avoid the disadvantageous effect mentioned above, and at the same time effective in terms of satisfying adequate commitment of the developed countries concerning GHG emission reduction.

CASE STUDY FOR BANGLADESH

Background

Economic liberalization, with more free-market oriented policy adaptation by the Bangladesh Government in the last six years, has sparked a massive growth in export. This rapid growth in export was also accompanied by an equally dramatic increase in import. Export has grown from US' $1.9 billion in 1991/92 to US $3.8 billion in 1995/96 at an average annual rate of 25%. During the same period, import grew from US $3.5 billion to $6.8 billion also at a remarkable annual rate of 23.6%.

By adopting an export-based growth strategy instead of an import substitution development scheme, the Government had to make many fundamental changes from the old fashioned controlled economy. Lifting of tariff and non-tariff barrier, freeing of Taka, abolishing of import licensing and the quota system, establishment of several export promotion zones (EPZs) with attractive incentives for foreign investors and many other measures taken by the Government have pushed Bangladesh more into the global free economy system. Free economy demands withdrawal of trade barriers which promote the free flow of goods across borders, guided by market demand.

Export

The major export products of Bangladesh over the last two decades have changed considerably. In the early 1980s, contribution of readymade garments (RMG) to the total export of Bangladesh was only 1.6%. Jute goods (46.6%), raw jute (16.0%), frozen food (10.5%), leather (8.4%), and tea (6.8%) were the major export items. In 1989/90, RMG overtook all others to become the most dominant export item at 40%, reducing jute goods to the second place at 21.7%. Frozen food and leather were the two other major contributors. In the year 1995/96, RMG and knitwear combined 65% of the total export. Jute goods (8.5%), frozen food (8.1%), and leather (5.5%) were the other significant contributors to exports. The dramatic growth of the RMG sector reduced tea from 6.8% in 1982/83 to only 0.9% in 1995/96. One interesting fact regarding these items is the domestic value added. While the domestic value added for jute, leather, tea, and frozen food is 60–70%, for RMG and knitwear it is only about 25%. For every dollar of RMG export, $0.75 worth of fabric and other related materials have to be imported. Once the generalized system of preferences (GSP) and quotas are withdrawn by the year 2002, Bangladesh will face stiff competition from other RMG exporting nations who also produce the raw materials (cotton and fabric). To avoid this very difficult problem, steps should be taken to produce high quality fabrics in Bangladesh and diversify exports.

RMG, knitwear, jute goods, frozen food, and leather have been chosen as the major export items of Bangladesh on the basis of the 1995/96 data. These items represent about 90% of the total export value. Many of these items are agriculture based and are not very carbon-intensive. Production of RMG and knitwear is also low carbon intensive. So, carbon tax on any of these items would not affect the production cost or the export volume.

North America and EU countries have been the major importers of Bangladesh products since the very beginning (Figure 10). Export to the African region which was about 13% in 1972/73, reduced to only 1.9% of the total export in 1995/96. Dur-

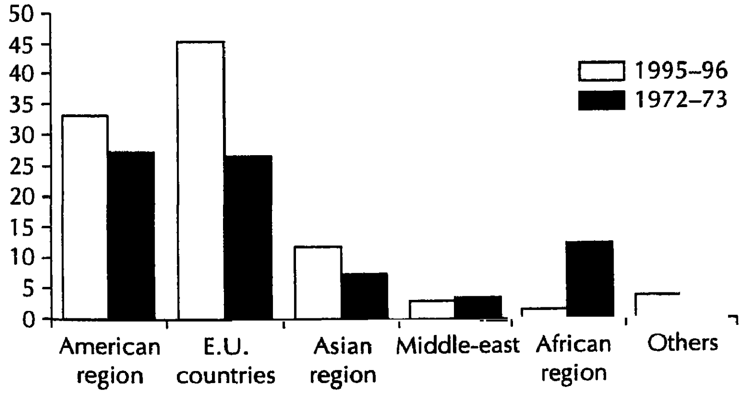

Figure 10. *Exports of Bangladesh to different regions of the world*

ing the same period, export to the EU countries and North America grew from 26.5% and 27.2% to 45.4% and 33.2%, respectively. The reason for such a shift is the replacement of jute as the major export item by non-jute products (RMG). Although the actual volume of jute items has not reduced much, the rapid growth of RMG export has reduced its percentage share of the export. Even under the overwhelming export volume of RMG/knitwear to North American/EU countries, export to the Asian countries remains at a healthy 12% in 1995/96. The total Bangladesh export in 1995/96 was 3.9 billion.

Import

Although export, as a percentage of import, has grown from a poor 36% in 1982/83 to a much healthier 57% in 1995/96, trade deficit in terms of dollar figure is increasing at an alarming rate. Trade deficit of $1.304 billion in 1981/82 has grown to about $3 billion in 1995/96.

Table 7 shows the quantity and value of import commodity by sections for the 1993/94 fiscal year. Petroleum and its products are not considered for the analysis because they are the primary energy sources. Primary food items are also not considered. A more detailed list of the import items are presented in Table 8. All commodi-

Table 7. *Export and import of commodity by section for 1993/94*

Section	Commodity	Value in million Taka, 1993/94	
		Export	Import
01	Live animal; products	10858	1925
02	Vegetable products	2060	10931
03	Animal/Vegetable fat/oil, edible fat Max.	21	4929
04	Prepare foods, beverage, spirit, tobacco	55	2553
05	Mineral products	474	20659
06	Product chemical or allied industry	1703	12229
07	Plastic, rubber, and articles thereof	24	6296
08	Raw hide and skin, leather, fur skin	6263	113
09	Wood and articles weed, cork, basket	558	829
10	Pulp wood, cellulosic, paper/board	7	3246
11	Textiles and textile articles	74464	35047
12	Footwear, headgear, umbrellas, feather	714	56
13	Articles stone, plaster, cement, glass	307	1884
14	Natural/cultured pearl, precious stone	—	68
15	Base metals and articles base metal	113	11896
16	Machine/mechanic-appliances, electrical equipment	759	16720
17	Vehicle, aircraft, vessel/trains equipment	110	5114
18	Optical, photographic, surgical instrument	90	1029
19	Arms ammunition and parts thereof	—	31
20	Miscellaneous manufactured articles	124	1820
21	Work of art, collectors pieces	35	165
	Total	98739	137540

Table 8. *Major import commodities 1993/94*

Major commodities	Value in million Taka	Value in million dollars	Major component	Volume '000	Unit	Value in million dollars	Unit price in dollars	Cost of energy $ per unit	Carbon content t carbon/ tonne
Dairy produce, egg, honey	1865	41.44							
Edible veg, root, tuber	1674	37.20							
Cereals	4989	110.87							
Oil seeds & oleaginous fruits	259	5.76							
Animal/veg oil	4928	109.51							
Sugar and products	1093	24.29							
Salt, sulphur, stone, cement	6050	134.44	Cement	2835.474	million tonne	93.22	32.87	8.2	0.2 + .135*
Mineral fuel oil, product	14598	324.40							
Inorganic chemical, compound	2619	58.20							
Org. chemical	2770	61.56							
Pharma products	1550	34.44							
Fertilizer	1509	33.53	Fertilizer	282.333	million tonne	33.53	118.78	11.9	0.25
Tanning/dyeing extract, pigment	1819	40.42							
Misc. chemical products	1081	24.02							
Plastics and articles	4890	108.67	PVC, Polyethelene	49.94	million tonne	29.27	577.78	70.00	0.3
Rubber and articles	1406	31.24							
Paper/board	2283	50.73							
Cotton	15320	340.44							
Manmade filaments	5592	124.27							
Manmade staple fibres	8862	196.93							
Special fabric trimming	1438	31.96							
Knitted fabric	1977	43.93							
Ceramic product	1064	23.64							
Iron or steel	6269	139.31	h/c st. (flat cold rolled)	233	million tonne	95.04	407.60	73.4	0.8
Iron/steel articles	1692	37.60							
Aluminium and articles	1682	37.38	Aluminium ingots	10.22	million tonne	12.11	1184.89	710.00	5 + .54*
Mech. m/c and equipment	10418	231.51							
Elect. m/c and equip	6301	140.02	Transformers	10534	Numbers	16.44	1561.07		
Vehicles and parts (non-rail)	4211	93.58	Passenger cars (all types)	4129	Numbers	18.44	4475.56		
Misc. manufactured items	1553	34.51							
Total	121762	2705.82				263.18			
Total import for 1993/94	137540	3056.44							

*Carbon emissions from the process

ore than Tk 1 billion[7] (US $22 million) have been included in
of the total import are food items (primary, intermediate, fin-
% of the import is to support the RMG industry and most of
ported as a finished product. Petroleum and its products consti-
rt bill. A large quantity of consumer and capital goods are also

scenario, a majority of the items are imported from Asian
to the 1993/94 import figures published by the Bangladesh Bu-
64% of the commodities are imported from Asian countries ex-
st. India (9.6%), Singapore (8.5%), China (8.4%), Hong Kong
, and South Korea (9.65%) are the major Asian exporters to
worthy that the import from Japan is only 8.6% and below that
A large amount of these goods are textile and textile articles.
.34% of its needs from the middle-eastern countries including
3/94, European countries' share was about 13.8%. The amount
from the EU countries was 11.34%. Import from the Americas
ut 10%. A more detailed figure is shown in Table 9.
mentioned that about 60% of the total import of Bangladesh
raw material, and machinery for RMG and petroleum and its
hese can be considered as high carbon-intensive products.
ew resources apart from natural gas. For its rapidly growing

or 1993/94

Value in Taka	Percentage of import
8293820	6.03
2331318	1.7
19083528	13.8
15606457	11.34
11475514	8.34
1030341	0.75
91658549	66.64
13218253	9.6
22014525	16.0
11765751	8.5
56425424	41.0
11600767	8.4
12578209	9.1
13282393	9.65
11817105	8.6
3485266	2.5
3151925	2.3
	1.0

construction sector (buildings, roads, bridges, industries, etc.), Bangladesh has to import most of the raw materials from abroad. Cement, aluminum, iron or steel, and PVC are the major commodities which have to be imported to support the growing construction sector. Polyethylene is also another item which has widespread use as a raw material. Although Bangladesh is self-sufficient in urea, almost all of its phosphate-based fertilizer has to be imported, which is the major item for the agriculture sector. Cement, fertilizer, PVC/Polyethylene, high carbon cold rolled flat steel sheets (iron and steel), and aluminium ingots are the five items chosen for analysis.

The effect of price increase of a particular item may not have much impact on the import cost, but the indirect effect could be significant with a disproportionate transfer of the costs to the consumers. This is particularly true in a sellers market as existing in Bangladesh, where consumers have little choice with a very limited competition in the market for most commodities.

In general, carbon tax may affect Bangladesh adversely because of its large import of capital goods which are carbon intensive. Also, considering the present export-import structure of Bangladesh, an increase in carbon tax would lead to higher expenditure on imports without offsetting the deficit through exports. This is because, Bangladesh export items are such that revenue through exports will not increase proportionately as that of increase in costs for imports. Thus, deficit import financing or even reduced imports will affect economic growth and GDP.

Apart from price increase of the exportable commodities of Bangladesh due to carbon tax, there is also the fear of non-tariff barriers (due to imposition of environmental norms) on the import of Bangladeshi products by the Annex 1 countries. Hence, there may be decline in exports and the cost of complying with the norms will raise export prices making Bangladeshi exports non-competitive. Thus, decline in export earnings will also have serious stress on economic growth.

To comply with the high standard norms of the developed countries, more money will be spent on efficiency improvements. Considering budgetary constraints, Bangladesh will have to be supported (financially and technologically) by external sources, particularly by Annex I countries, in order to achieve the objectives of emission reduction globally.

Carbon tax may affect Bangladesh adversely as it imports carbon-intensive capital goods. Non-tariff barriers may be imposed by Annex I countries requiring efficiency improvements. Compliance with these standards set by developed countries will necessitate technical support for investments.

CONCLUSIONS: KYOTO AND BEYOND

This paper has analysed the impact of a carbon tax imposed by Annex I countries on three different types of developing economies. A partial analysis has been done for India where likely impacts on trade with a single trading partner, the US, have been assessed. Export and import prices increase depending on the share of different forms of energy, the share of these in the cost of production and the rate of carbon tax. The results show a marginal loss in GDP. For Indonesia, a system dynamics model was used. The case study concludes that the negative impacts of an Annex I carbon tax on the Indonesian economy are minimal. These could be significant if the degree of technological dependence is high. Bangladesh's case is similar. About 40% of its imports are of capital-intensive goods but much of these are from other Asian countries. The impact of a carbon tax may be important for the economy if increased prices of imports generate a price spiral in the economy.

Several indirect impacts have not been captured in these exercises for three developing economies. For example, if exports to the US or to OECD countries decline, there is the possibility of enhanced exports to non-Annex I countries, that is, South-South trade can increase. This represents a strong possibility as the southern economies are the ones which will have higher growth rates compared with the Annex I economies and that is where potential markets would be. The direction of trade for Bangladesh shows that a small percentage of the trade is with the OECD, most of it is with other Asian countries.

What are the implications from this analysis? The impact of commitments by Annex I countries on developing countries is likely to be limited. Certain economies may get affected adversely, but then there is the possibility of developing South-South trade. Fast growing developing economies with a large industrial base such as Korea, China, Brazil, and India are likely to expand production of capital goods which were thus far available from the Annex I bloc only. Another positive long-term impact will be the price-induced impetus to develop indigenous industry in developing economies and a move away from the production of primary goods for world markets. Higher production costs in Annex I countries will spur a faster transfer of technology and the construction of a larger industrial base in developing economies. This development is desirable not only for the developing countries but also from the global point of view. A more rapid development of technology will move developing economies faster on to a more efficient production path and higher levels of per capita incomes. Higher levels of well-being in non-Annex I countries would imply a move towards stabilization and subsequent reduction of emissions by these economies as well and hence a global stabilization and reduction of emissions (in consonance with the theory of Environmental Kuznets Curves).

Impacts of commitments of Annex I countries on developing countries to comply with emissions reduction targets *prima facie* are marginal. Economies importing capital- intensive products from Annex I countries are likely to have adverse second-order impacts. In such a scenario, there is a case for increased South-South trade with increased flows from countries with a large industrial base. Higher costs in Annex I countries will have a twofold effect on developing economies in the long-term: more rapid evolution of their indigenous industrial base and positive environmental transitions that accompany development.

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ABOUT THE PROJECT

TERI is a leading policy research institution in the developing world and has the distinction of being the first developing country institution to launch research activities on climate change, as early as in 1988. Over the years TERI has undertaken projects on estimation of greenhouse gases, identification and assessment of mitigation options, and impact of climate change. It has contributed significantly to the international debate on strengthening the implementation process under the UN Framework Convention on Climate Change, as well as projecting concerns of the developing countries. Since early 1997, the Swiss Agency for Development and Cooperation has sponsored and supported an initiative launched by TERI to prepare for the third session of the Conference of the Parties, an important milestone in the current negotiations process. This initiative focuses on examining the Framework Convention on Climate Change: adequacy of commitments, economic implications of Annex I commitments for developing countries, and capacity building for stimulating technology transfer in the context of climate change.

INFRAS AG, a Swiss consulting organization, also has contributed to this effort and played a key role in enabling the review of the first draft of the papers. INFRAS AG has also prepared a paper on the scope of setting long-term carbon emission targets aiming toward North-South convergence as supported by the Second Assessment Report of the Inter-governmental Panel on Climate Change (IPCC).

ABOUT THE PUBLICATION

This publication on *Economic implications of Annex I commitments for developing countries* examines the claim that legally binding commitments undertaken by Annex I Parties would result in adverse economic impacts on developing countries. This is accomplished through three case studies, the first analyses the case of the Indian economy which has a large industrial base; the second elaborates the case of Bangladesh which is heavily dependent on natural resources; and the third focuses on the oil exporting economy of Indonesia. This study reveals that impacts of commitments of Annex I countries to comply with emissions reduction targets on developing countries, *prima facie*, are marginal. Economies importing capital-intensive products from Annex I countries are likely to have adverse second-order impacts. In such a scenario, there is a case for increased South-South trade with increased flows from countries with a large industrial base. Higher costs in Annex I countries will have a two-fold effect on developing economies in the long-term: more rapid evolution of their indigenous industrial base and positive environmental transitions that accompany development.